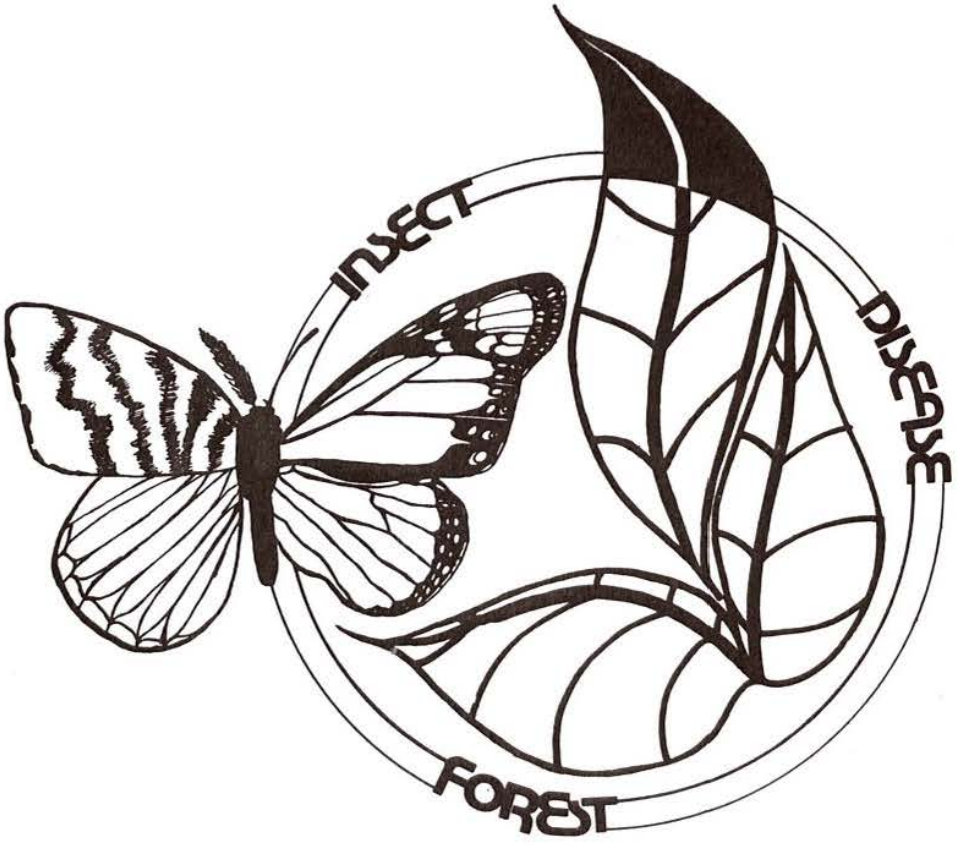
MISSOURI FOREST PEST REPORT 1987



Missouri Department of CONSERVATION

Forestry Division

MISSOURI FOREST PEST REPORT

Missouri Department of Conservation Forestry Division
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INTRODUCTION

We welcome Dr. Christopher J. Luley to our Forest Pest Management staff, Forestry Division, Missouri Department of Conservation. Chris joined the Department in February, 1987. He previously managed the Plant Diagnostic Laboratory at Iowa State University and brings a wealth of diagnostic experience as well as a general expertise in plant pathology.

The winter of 1986-87 was rather mild. Precipitation amounts were rather low and spring arrived about one month earlier than normal. Spring rains generals were sparse and spotty over the state. We went into summer very dry.

Missouri summer 1987, was very dry. Even though spotty showers did occur, generally subsoil moisture was badly depleted. Trees began loosing their leaves in August. Fall coloration of hard maple and smooth sumac was hastened by the drought. We will continue to see trees dying that were stressed from previous years and this years drought. Once treees are stressed beyond recovery, they eventually die.

Tree mortality in the urban setting was common because of soil compaction, soil removal, root destruction, use of herbicides, and girdling with mechanized equipment. This years drought also contributed significantly to urban tree problems around the state.

Department personnel were very busy servicing forest pest inquiries this year. Numerous insect and disease occurrences created problems for owners of forest trees, foresters, Christmas

tree producers and anyone else involved with growing trees. We serviced a great variety of inquiries involving insect and disease control and identification. Forest Pest Specialists and Forest District Personnel are receiving more inquiries each year because more people are becoming more concerned and aware of pest problems on their trees and are becoming more aware of our Pest Management Program.

Included in this report are pests that have caused damage to forest and urban trees during 1987. Some of the insects and diseases lowered the ornamental value of trees, while others caused log and lumber degrade and timber loss.

THE PROGRAM

In 1962, a cooperative program, the Forest Pest Control Program, was entered into with the U.S. Forest Service by the Forestry Division, Missouri Department of Conservation. Under the original agreement the effort is designed to detect, evaluate and control forest insects and diseases on state and private land. Department foresters and other personnel report occurrences of damaging insects and diseases. Forest Pest Management Specialists coordinate the program.

Insects, diseases and drought, can cause damage to trees and shrubs which may go unnoticed until mortality occurs. Tree losses occur on an annual basis in the forest from hardwood borers and defoliators; pine cambial feeders, root rot, canker and stem diseases; drought and over maturity.

Trees under stress were vulnerable to attack by insect

borers, and a host of canker fungi and root rot fungi. Some factors which stress trees are drought, compacted soil, root disturbance, lightning strike, insufficient soil elements and wet or dry soil conditions to list just a few. Maintaining tree vigor is the most important consideration to insuring a long life.

CONDITIONS IN BRIEF

Weather conditions for Missouri in 1987 included a mild winter, an early, warm, and dry spring and a hot, dry summer. The mild winter resulted in negligible winter injury to conifers in most areas of the state. Foliar and shoot diseases of hardwood and conifer species also caused minor damage this year because of the abnormally dry spring and summer weather that limited their development. Low infection levels were observed for anthracnose of sycamore and other hardwoods, actinopelte leaf spot of oak, Diplodia tip blight of pine and other diseases that are usually important in years with wetter weather.

An outbreak of Lophodermium needlecast on Scotch pine in Christmas tree plantations and increased levels of pine needle rust on shortleaf pine were evident in some areas. Symptoms of both diseases appeared in the spring of 1987 from infections that occurred during the wet fall weather of 1986. Large populations of the European pine sawfly were also found on Scotch and mugo pine, however, populations of the redheaded pine sawfly remained at moderate levels.

Drought conditions during the growing season increased decline and stressed related problems in forest and ornamental

trees. Hypoxylon canker, two-lined chestnut borer and oak decline and mortality were prevalent on oak species. Pine wilt disease, which is epidemic on scotch pine, killed a large number of trees in 1987.

FOREST INSECTS

European Pine Sawfly - occurred in heavy numbers on Scotch and mugo pines this spring in scattered locations around the state.

Fall Webworm - occurred in high to moderate numbers on walnut trees and other hardwood species in southwest Missouri in 1987.

Gypsy Moth - during July and August of 1987, five male moths were recovered from traps in Missouri. Of these five, three were trapped in St. Louis, one near Eolia in Pike County and one on northern Jefferson County. Personnel from U.S.D.A., A.P.H.I.S, P.P.Q furnished all traps (7,448) and personnel from Missouri Department of Agriculture trapped and coordinated all the trapping in the state.

Redheaded Pine Sawfly - populations remained constant from 1986. Early spring and summer predictions of heavy infestation did not materialize.

Spider Mites - were not as serious over the state as populations in 1986. Minor infestations did occur on Scotch pine and spruce.

FOREST DISEASES

Ash Yellows - white and green ash exhibiting symptoms of ash yellows were observed in Buchanan, Platte, St. Louis and Livingston counties. Root samples of the trees in Poosey State Forest, Livingston county are being tested for the mycoplasma.

Actinopelte Leaf Spot - very low infection levels were evident on oaks statewide.

Cercospora Blight - caused premature defoliation and lower branch dieback on eastern redcedar. Young trees growing in weedy, open fields were the most severely affected.

Diplodia Tip Blight - new branch tip infections on Austrian and Scotch pines occurred at relatively low levels. Branch dieback from previous years' infections continued to occur on older pines.

Dutch Elm Disease - continued to kill American elms statewide. Most mortality occurred in urban areas.

Drought Damage - was present on a wide range of hardwood species and caused premature browning, leaf drop and tree mortality on forest and shade trees around the state.

Fusarium Canker - Fusarium solani - was isolated from cankers on black walnut. The fungus was recently proved to be a new canker pathogen in Kansas. The disease was found only in a Texas county plantation, however, isolations made from previous years indicate the disease is more widely distributed.

Hypoxylon Canker - was prevalent on a wide range of oak species particularly oaks weakened by drought stress.

Lophodermium Needlecast - caused premature defoliation on Scotch pine in Christmas tree plantations. The outbreak of the needlecast was found in plantations scattered around the state.

Mycosphaerella Leaf Spot - of black walnut was identified in two counties. The leaf spot has not been previously reported in the state.

Oak Decline - continued to cause dieback and mortality of oaks (mainly scarlet, northern red, black, pin and white oaks) in both forest and ornamental situations.

Pine Needle Rust - elevated infection levels were present on shortleaf in some areas, although damage from the disease was generally minimal.

Pine Wilt Disease - killed a large number of Scotch pine statewide and is considered epidemic on this species in Missouri.

Sycamore Anthracnose - was present at low levels and caused minimal damage to sycamore in comparison to previous years.

PROJECTS

The cooperative team effort of Department Foresters and Forestry Division staff specialists resulted in a well-coordinated, successful Forest Pest Management Program in 1987. Over 3,250 forest and shade tree requests were serviced statewide in 1987. The services of staff specialists were available to foresters and others. In February and March, two Pest Management sessions were held in St. Louis and Kansas City for Department Foresters and personnel associated with the green industry. In May, four pest management sessions were held in Springfield, Salem, Piedmont and Moberly for our District Foresters. These meetings are designed for foresters, arborists, and urban forest pest management personnel. Over 355 people attended these six meetings. Department Foresters and staff specialists serviced over 1,800 pest related telephone calls. Over 1,00 diagnoses of tree problems were made for the state. Forest Pest Management Specialists and District Foresters presented technical sessions

to arborists and at regional technical seminars and conferences.

Gass and Luley conducted detection and evaluation surveys on major insect and disease problems in 1987 on 5,000,000 acres. Reports were prepared and submitted to the U.S. Forest Service.

A total of five Forest Insect and Disease Status Reports (April through August) were prepared and sent to all Missouri Christmas tree producers, most Department personnel, and other individuals involved in tree care, totaling 1,200 copies per month.

Gass and Luley attended the annual State Cooperators Meeting hosted by the U.S. Forest Service in St. Paul, Minnesota in March.

Luley conducted a fungicide spray trial at the George O. White Forest Nursery. The fungicides benlate and manzate were evaluated for control of Phomopsis blight of 1-0 eastern redcedar seedlings. Specific treatments used and results are reported in the appendix page x.

A cooperative project with the University of Columbia-Missouri was funded by the Department to study the transmission of pinewood nematode to Scotch pine by the insect vector Monochamus carolinensis. Dr. Marc Linit, entomologist with the University, is the principal investigator of the project which is scheduled to be completed in June, 1989. Dr. Linit will study the effect of nematode transmission by the insect on branch and tree mortality. He will also research the influence of the environment on efficiency of nematode transmission through feeding wounds.

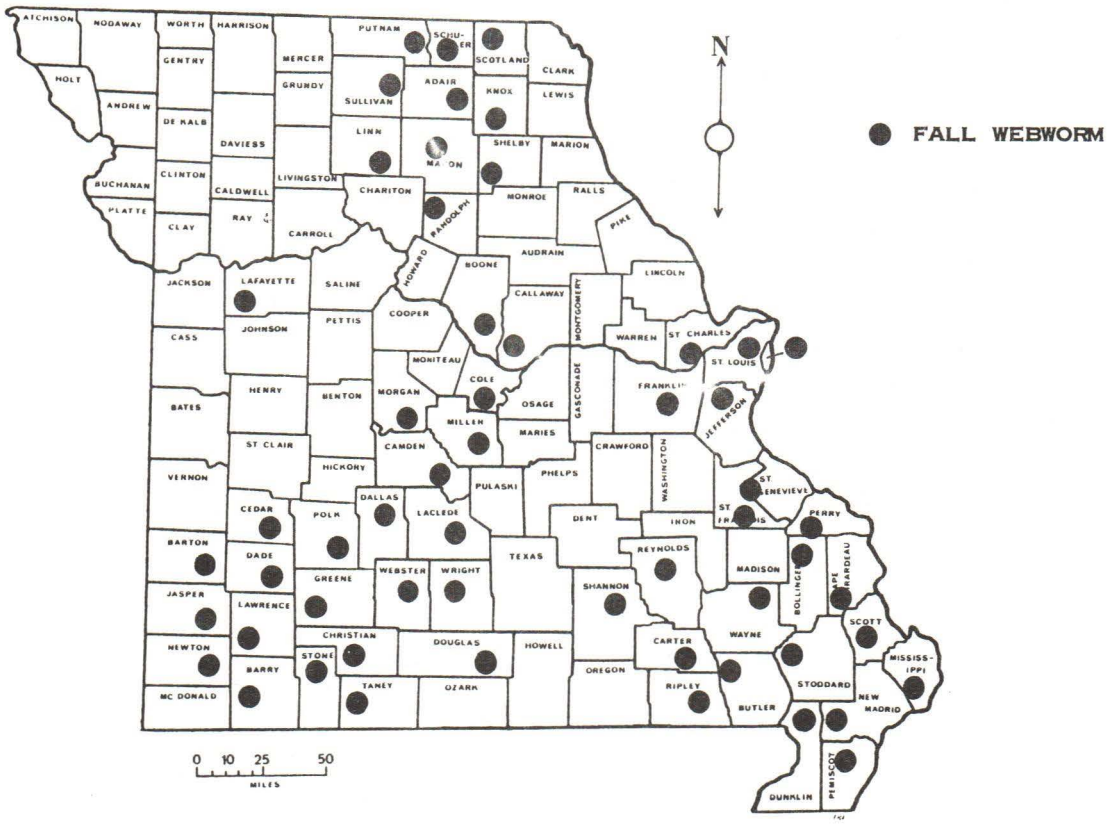
We completed our sixth season with the Integrated Pest Management Program (IPM) with the University of Missouri-Columbia. This multi-state reporting program has been developed to collect and computerize pest occurrence data for most economic plant pests in the state. Forestry Division is reporting results to the IPM Program for incidence of insects and diseases on forest and ornamental trees.

HARDWOOD DEFOLIATORS

Eastern Tent Caterpillar - populations were low to high over the south one-half of the state in the spring on wild black cherry shrubs and trees. Webbing intensity varied from one web per tree to four or five webs per tree.

Trend - populations should be moderate to heavy in 1988.

Suppression - no control was carried out.

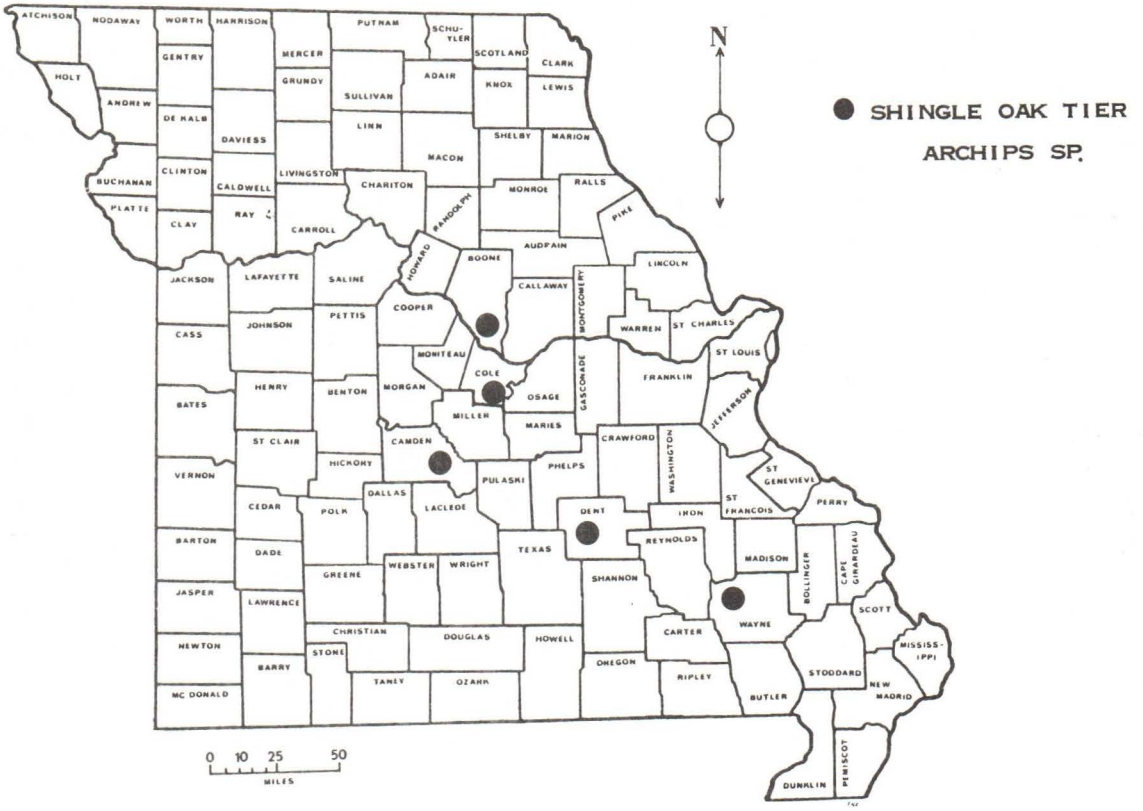


Fall Webworm - populations were moderate to heavy in southwest Missouri and light to moderate in north central, south central and southeast. Webbing of black walnut, pecan, hickory, persimmon and redbud was common.

Trend - populations should be moderate to heavy in 1988.

Suppression - various walnut and pecan growers sprayed their trees to control this insect.

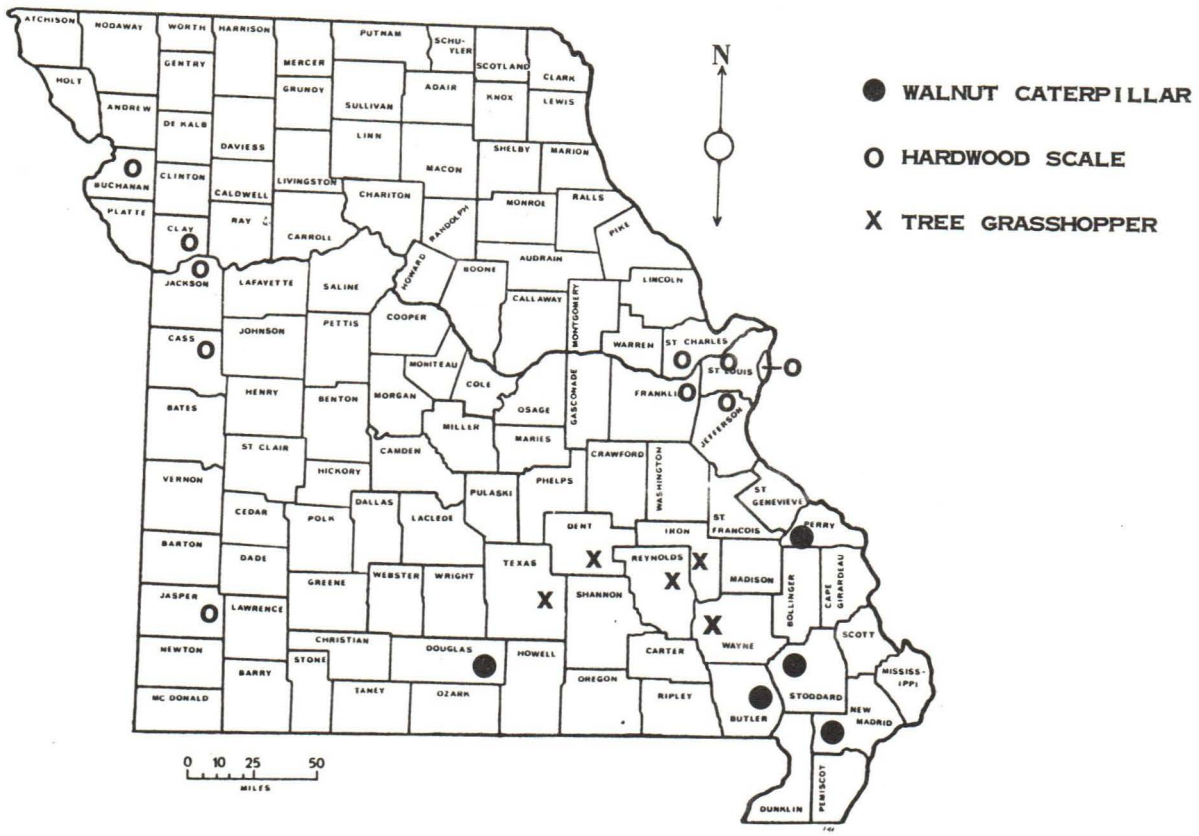
Gall Insects - numerous reports were received statewide regarding heavy gall infestations in 1987. Gall insects such as flies, wasps, psyllid gall insects and mites are active in spring. These insects lay their eggs in succulent leaf or twig tissue where the swollen parts eventually develop. Galls commonly



observed are on hickory, hackberry, pin oak, burr oak, hard maple, and silver maple. Elm and walnut leaves also have galls in early summer. Woody stem galls are common on pin and shingle oak.

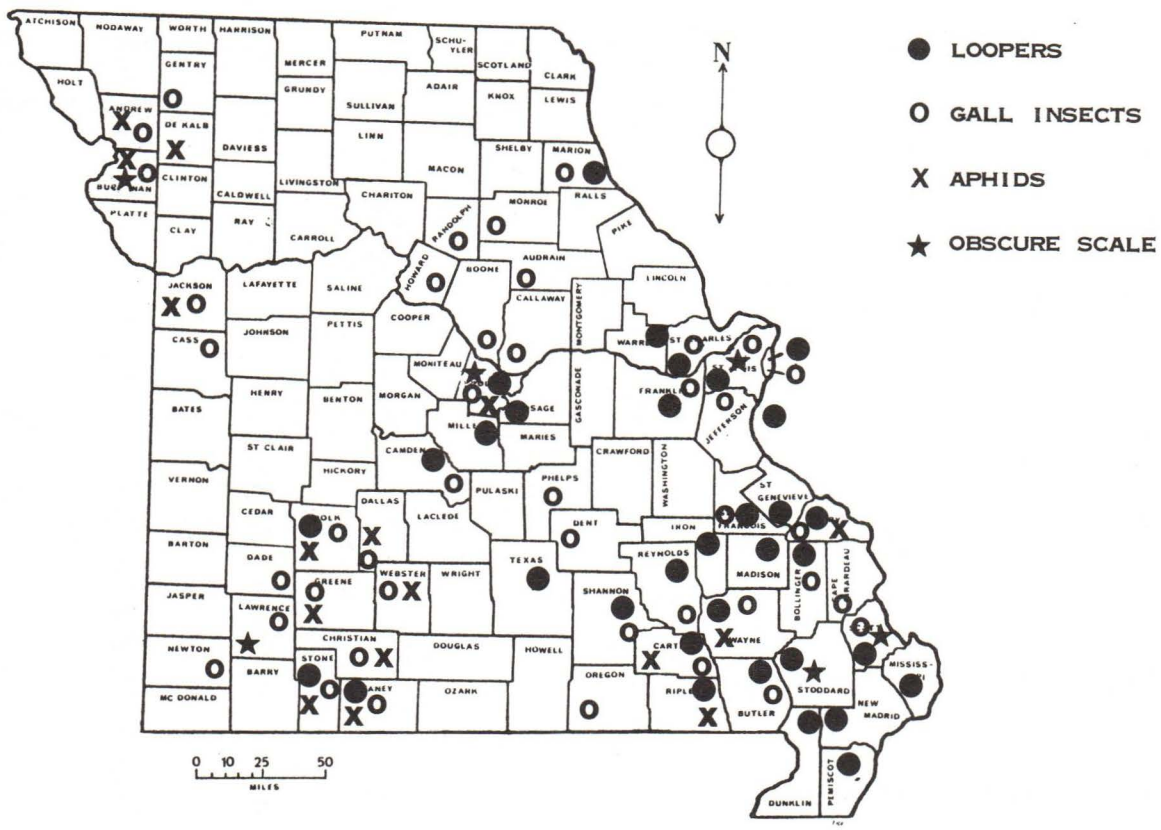
Trend - insect gall infestation is a part of nature. We will always have gall insect formation with cyclical flucuations. Galls will always be difficult to control.

Suppression - no control was conducted for gall insects in 1987.



True Tree Grasshopper - cause moderate to heavy defoliation in Iron, Reynolds, Wayne, Dent and Texas counties. Its preferred hosts are white oak, red oak, hickory and flowering dogwood. Feeding produces a lacy appearance to the foliage. It is an insect of the forest and no control was necessary.

Trend - populations in 1988 should be low causing light defoliation.

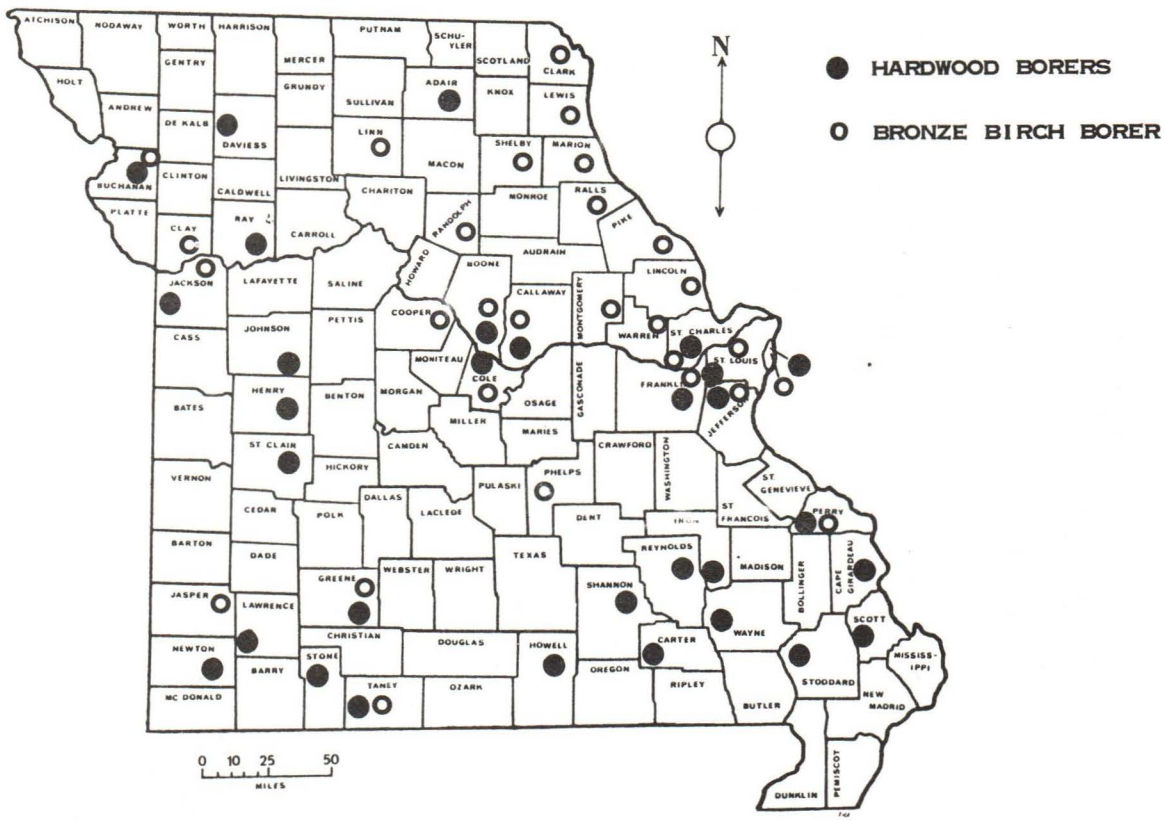


Walnut Caterpillar - populations were light to moderate over the state on black walnut, pecan and hickory. Leaf feeding begins in July and ends in September. Other Datana species feed on red oak, post oak, huckleberry and sumac.

Trend - populations in 1988 will be light to moderate in most areas of the state.

Suppression - a number of nut growers sprayed their trees for this insect with an approved insecticide.

Gypsy Moth - during the summer of 1987, the gypsy moth defoliated over 1,329,653 of forest land in the northeastern United States.



Defoliation was the greatest in Pennsylvania with 795,431 acres. Spot infestations still remain in several states while the infested range continues to grow in central Michigan. Personnel of the Missouri Department of Agriculture trapped three male moths in the St. Louis area, one near Eolia in Pike county and one in north Jefferson county. To date, no spot infestations have been discovered in Missouri. In 1987, 7,448 gypsy month traps provided by U.S.D.A., A.P.H.I.S., P.P.Q., were located and monitored by personnel of the Missouri State Department of Agriculture, Plant Industry Division and in cooperation with the U.S.D.A., Animal Plant Health Inspection Service. Other cooperating agencies were the Department of Natural Resources State Parks and Historic Preservation, National Campers and Hikers Association, Corp. of Engineers and John Grinstead at Fort Leonard Wood.

The gypsy moth is not native to the United States, however, its life cycle does parallel that of a number of other native insects. Gypsy moth larvae feed in spring and early summer on a variety of hardwood foliage. With three repeated defoliations of hardwood, tree mortality can occur. One defoliation can kill evergreen trees such as pine or cedar.

Looper Complex - although defoliation was low to moderate this group of insects was represented in many counties during 1988. The term, looper complex is used to describe at least five different insects which emerge and feed on a variety of hardwood foliage at the same time of the year. Common loopers are the

linden looper, elm span worm, spring cankerworm, leaf roller and leaf tier. It may take four or five years for looper complex populations to build to a high level. Predators and parasites usually are responsible for the collapse of large populations of the looper complex.

Trend - populations should be moderate in 1988.

Suppression - no suppression work was done in 1987.

Scale Insects - as a group, infest a variety of hardwood trees throughout the state. These are more common on ornamental hardwood trees such as pin oak, Euonymus, and white and post oak. Some of the scale which were reported during 1988 were obscure scale on pin oak, Euonymus scale on Euonymus, and Kermes scale on white and post oak. The most devastating scale is the obscure scale which infests pin oak, weakening it and causing decline and mortality.

Trend - scales will continue to increase and cause decline on stressed hardwood trees. Scales will flucuate on some tree species depending upon its life cycle.

Suppression - arborists use dormant oil and an approved insecticide to control the scale crawler stage in spring.

HARDWOOD BORERS

The Carpenter worm and Red Oak Borer - and other living tree hardwood borers as part of our endemic, indigenous borer populations continue to infest hardwood trees in our forested and urban areas of the state. Hardwood borers are a major problem on many hardwood trees in urban areas.

Trend - borer infestation will continue in hardwood trees occupying poor sites. Estimated dollar loss to the hardwood borer complex amounts to $2,500,000 annually through lumber degrade and ornamental tree loss.

Suppression - selective tree harvest, sanitation harvest and stand conversion, from hardwood to pine were conducted in forested areas over the state. Some shade tree owners controlled borer infestations on high value trees.

The Cottonwood Twig Borer, Cottonwood Borer, Cottonwood Leaf Beetle and Poplar Tent Maker - continue to infest cottonwood where it grows. Borer damage is greater in trees growing on poor sites. Defoliation by the Poplar Tent Maker occurs almost everywhere cottonwood grows.

Trend - no increase in infestation is expected in 1988.

Two-lined Chestnut Borer - is a secondary attacking insect of stressed oak trees. It plays a role along with various root rots and Hypoxylon canker in finally killing stressed oak trees. Beginning in 1978 and through 1980, moisture was a limiting factor for tree growth, triggering attacks by the two-lined chestnut borer and root rots. In 1983 and 1984 drought conditions prevailed from late June through September over most of the state. As a result of the effects of drought, many more oak trees were lost. Other tree stressing factors are late frosts, poor sites, and spring defoliating insects.

Trend - the summer of 1987 was generally very dry over the state. Mortality will occur once again in our forests due to the deficiency in rainfall. Trees are continually dying in the forest as part of the natural succession of a maturing forest. Drought along with a combination of other factors will always play a role in tree mortality. In 1988, without stressed and accelerated tree mortality will occur.

Suppression - drought hazard sites must be recognized by the forester and managed in such a manner as to consider species composition, where hardwood basal area is too low alternatives such as even-aged management or pine conversion should be considered within the shortleaf pine range. On droughty, poorer hardwood sites the entomological and pathological rotation should be applied rather than a fixed rotation age.

Bronze Birch Borer - populations continue to infest stressed white birch over the state causing extensive mortality. The insect is attracted to white birch wherever it grows.

Trends - stressed white birch will continue to die as a result of the stress factor which is usually drought and from bronze birch borer infestation.

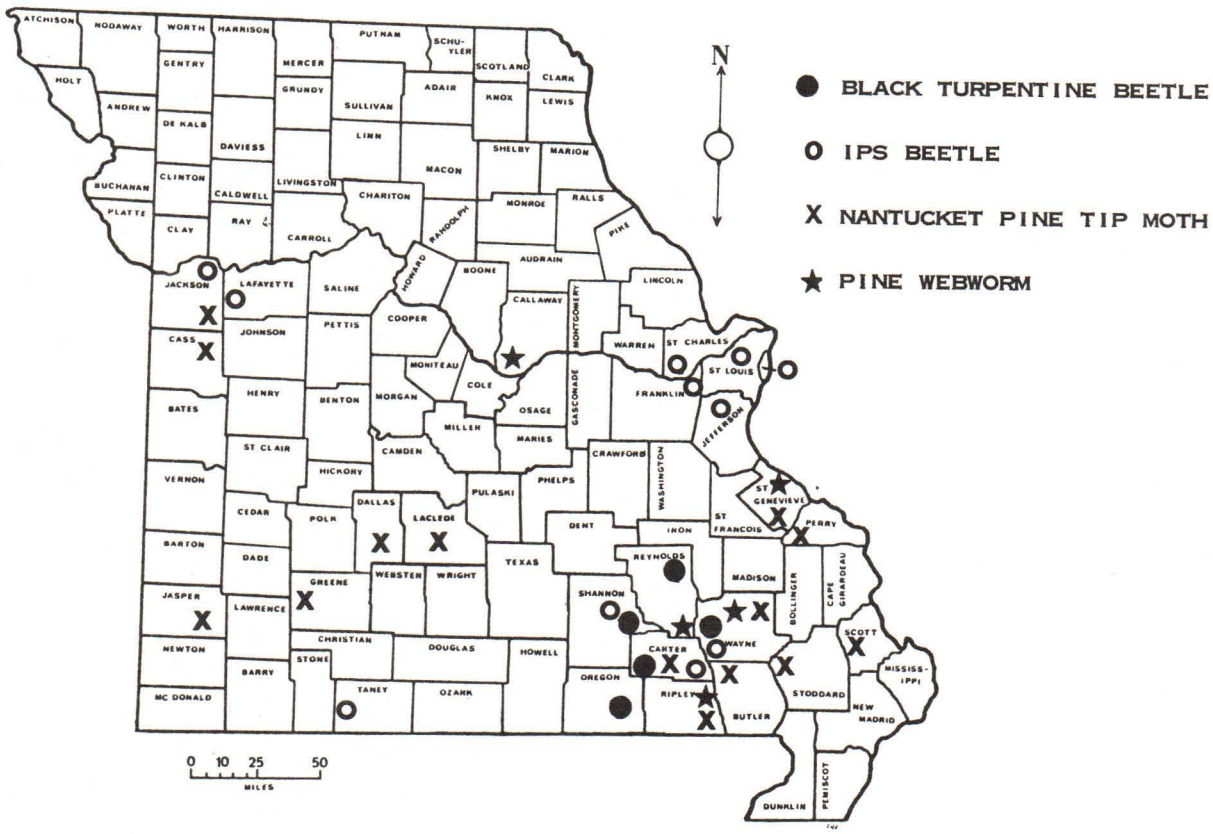
Suppression -a number of owners spray or have arborists spray their white birch trees. An effort is being made to acquaint nurseryman and landowners with our native river birch as a substitute for white birch.

PINE AND CEDAR TRUNK BORERS, TWIG BORERS

Black Turpentine Beetle - light to moderate infestation was reported from Reynolds, Wayne, Shannon, Oregon and Carter counties. The black turpentine beetle infests weakened shortleaf pine trees, those damaged in a timber sale, damaged during building construction, wind thrown or those struck by lightning. Once the infestation has proceeded and is successful, the Ips beetle can also develop, completing the process of killing the tree.

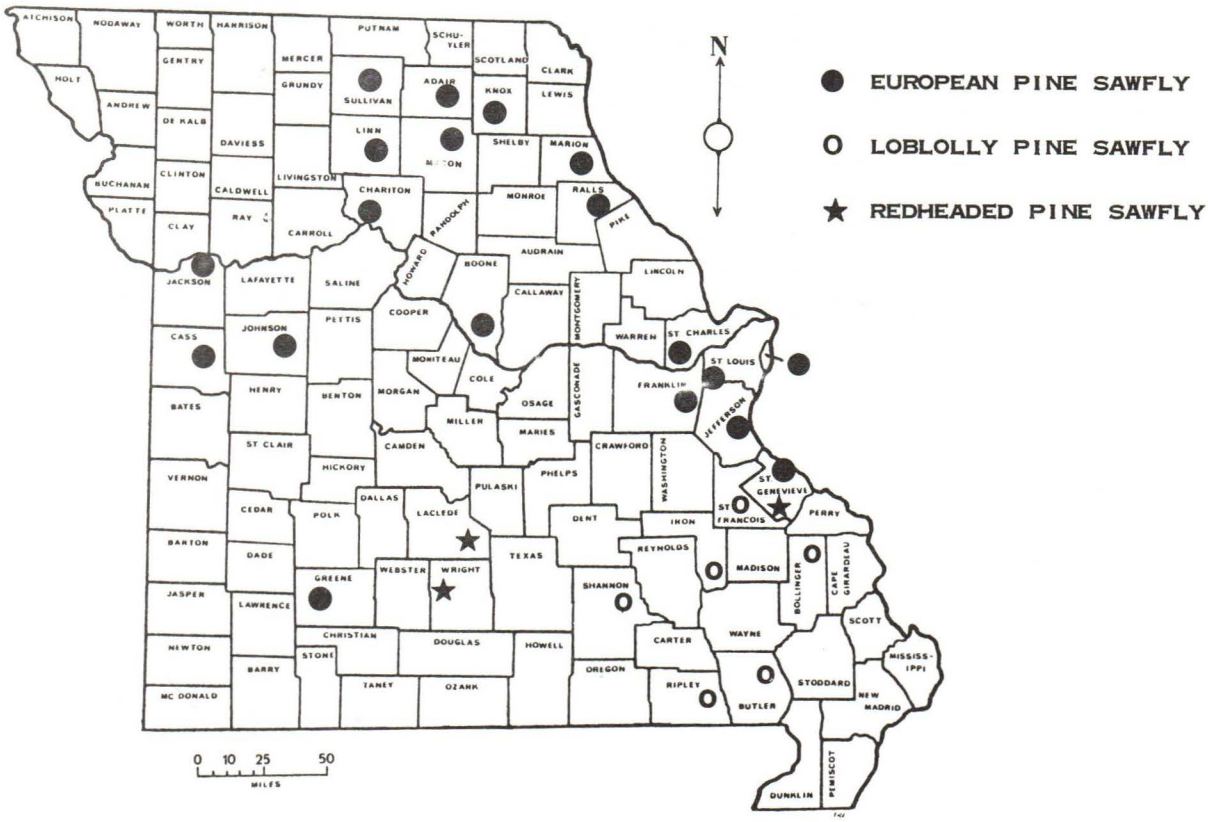
Trend - beetle populations will develop where shortleaf pine trees are disturbed either naturally or artificially.

Suppression - where feasible, attacked trees are removed as timber cutting progresses in timber sale areas.



Ips Beetle - is a weak attacker of live, healthy shortleaf pine trees. It is most usually detected on very stressed pines and pines that have infestations of black turpentine beetles. If new pine slash is created, Ips often infests this slash and will later infest live, healthy neighboring pine trees. Ips was reported from eleven counties in 1987. Ips has also been attacking white and Scotch pine in the St. Louis and Kansas City regions.

Evergreen Bagworm - infestations of bagworm were light to heavy on upright pfitzer junipers over the state. Often, heavy defoliation of a juniper can cause death over a two or three year period.



Trend - bagworms will continue to threaten unsprayed ornamental evergreen. Populations are expected to be light to heavy statewide in 1988.
Suppression - some owners of evergreens had their shrubs sprayed by tree service companies.

European Pine Sawfly - populations were light to moderate in size during 1987 with defoliation of mugo and Scotch pines being moderate. Reports were sent listing 19 counties where defoliation was observed. Affected trees were grown for ornamental or Christmas tree purposes. This insect is a spring and early summer feeder.
Trend - populations will be moderate to heavy again in 1988.
Suppression - a number of Christmas tree producers and homeowners sprayed their trees and shrubs for the European pine sawfly.

Loblolly Pine Sawfly - populations were light to moderate in 1987. This is an early summer defoliator of shortleaf and Scotch pines.
Trend - populations will be light to moderate in 1988.

Suppression - no control work was required.

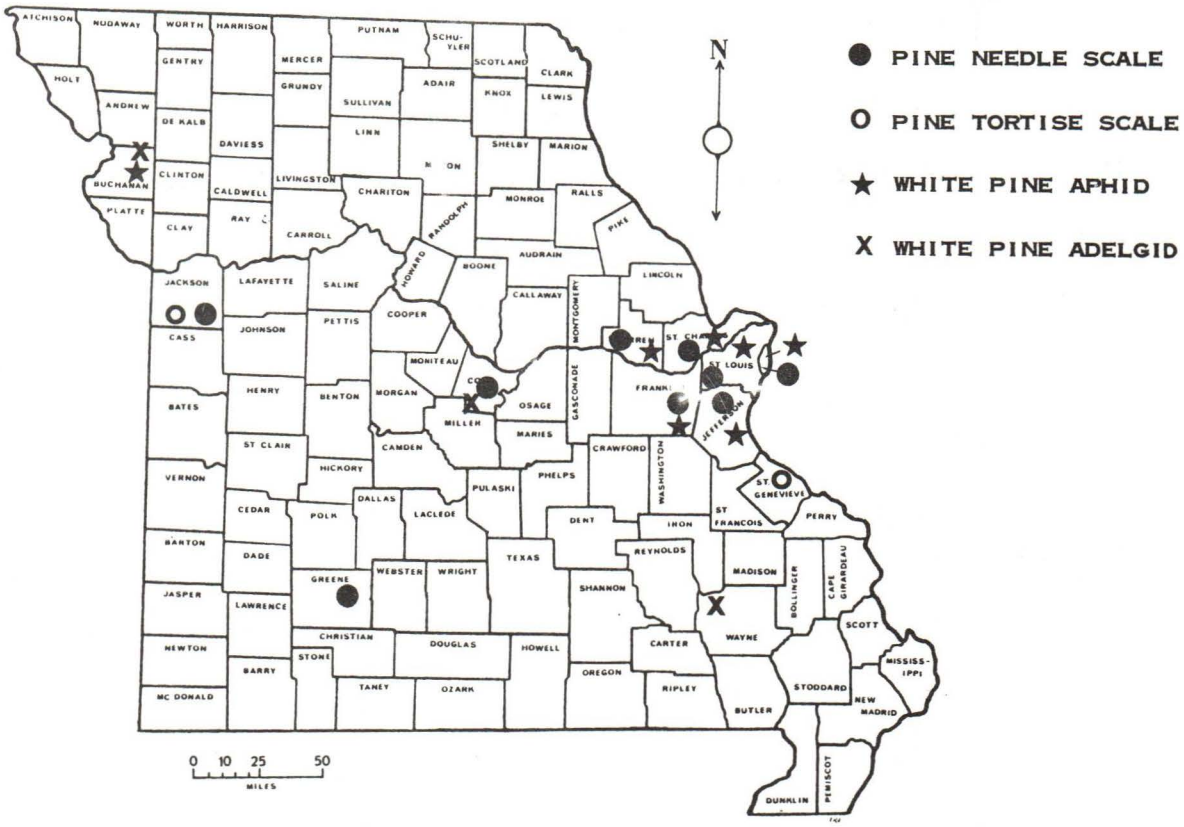
Redheaded Pine Sawfly - populations were light in 1987, being reported from three counties in south Missouri Defoliation was light in scattered shortleaf pine plantings.
Trend - populations will be light in 1988.

Suppression - no control work was done in 1987.

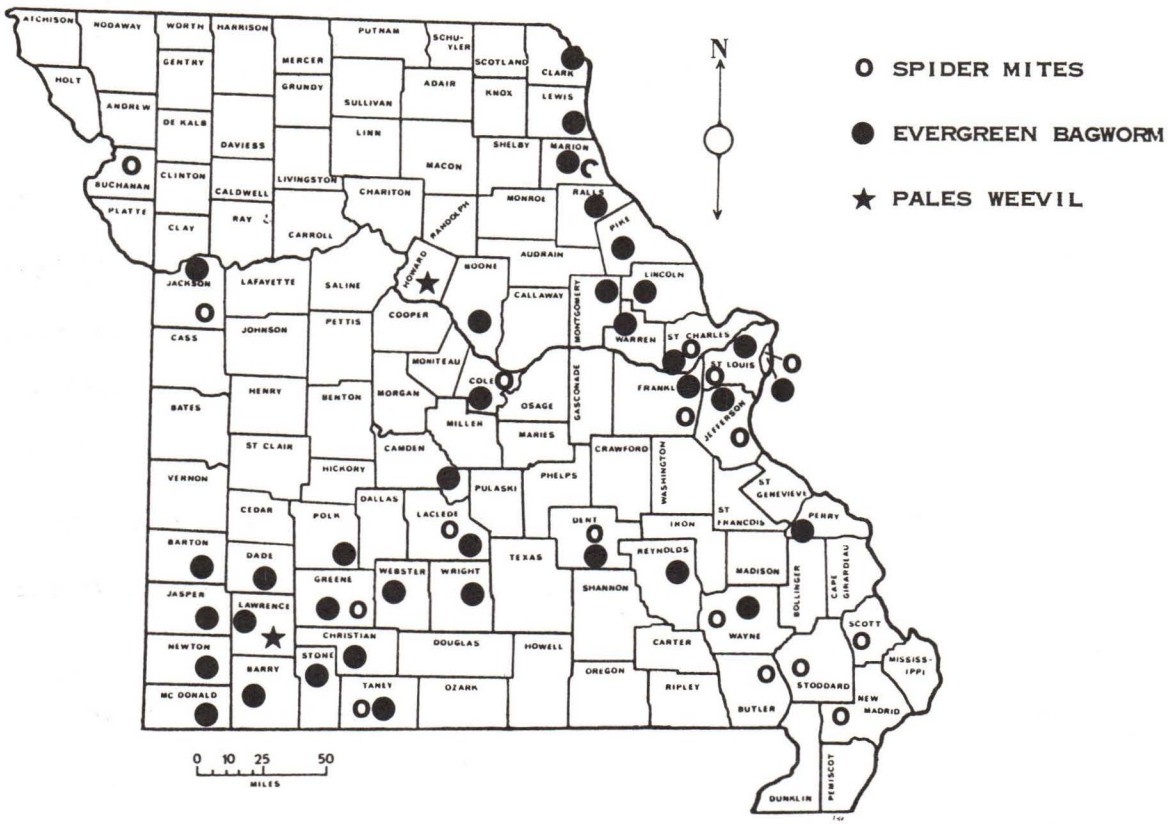
Pales Weevil - populations were low in 1987. Infestations were reported for two counties here feeding and flagging occurred in Christmas tree plantations.

Trend - populations should be light in 1988.

Suppression - no suppression was required this year. Our standard control recommendation is to spray stumps produced during the previous Christmas with Thiodan and diesel fuel in March of the following year. Unless growers already have the problem they usually don't take control measures to prevent possible weevil buildups for the following year.



Pine Needle Scale - populations were moderate to heavy in scattered areas around the state in 1987. The scale occurs on Scotch and Mugo pines and this year was reported from Jackson, Greene, Cole, Warren, St. Charles, Franklin, Jefferson, St. Louis counties and St. Louis city. Scales build on needles in such large numbers that the plant appears to be whitewashed. Infestations are building to levels where control is imperative or plants will be lost. There is also a potential for spread to surrounding trees and shrubs. Although the pine needle scale is difficult to control, superior dormant oil can be used any time of the year and sevin or Dursban can be used to control the crawler stage sychronized with lilac blooming in spring.



Trend - populations seem to be increasing. Unless a natural factor or factors occur to eliminate present populations, we will see increased activity in 1988.
Suppression - several growers sprayed individual and selected trees and shrubs to control pine needle scale.

Pine Webworm - populations increased in 1987. The pine webworm adult is a moth. The larvae feed on needles of shortleaf and Scotch pines and creates a packed mud-like cluster on the top of the main stem. Defoliation occurs mostly on smaller pine trees which retards growth and causes an unsightly tree. Infestations occurred in Callaway, Ste. Genevieve, Reynolds, Wayne, and Ripley counties in 1987.
Trend - populations will build in 1988.
Suppression - certain Christmas tree producers sprayed their Scotch pine trees with an approved insecticide.

Pine Tortise Scale - infested trees in Jackson and Ste. Genevieve counties in 1987. This insect does not normally become epidemic in a planting because of natural predation by lady beetles and predaceous bugs. Only larger trees are usually affected in scattered plantations.

An infestation can be detected by the honeydew which has molded imparting a gray or black cast to the infested portion of the tree.
Trend - populations should be light to moderate in 1988.

Suppression - Christmas tree producers were advised to spray dormant oil on only those trees infested prior to winter. If required, growers will spray their infested trees in late May of 1988 with Sevin or Dursban to control the crawler stage of the scale.

Spider Mites - are normally a nuisance on various tree species in summer. Infestation was light to medium over the state in 1987. Reports of occurrence were received from eighteen counties. Spider mites are especially damaging to Scotch pine, baldcypress, Norway spruce, white pine and Colorado and White spruce. Our traditionally hot and dry summers make ideal feeding conditions for most species of spider mites on needles of conifers. Feeding by spider mites produces a light-green color to the needles. Upon closer examination, egg cases, mites and webbing can be observed on infested plant material.

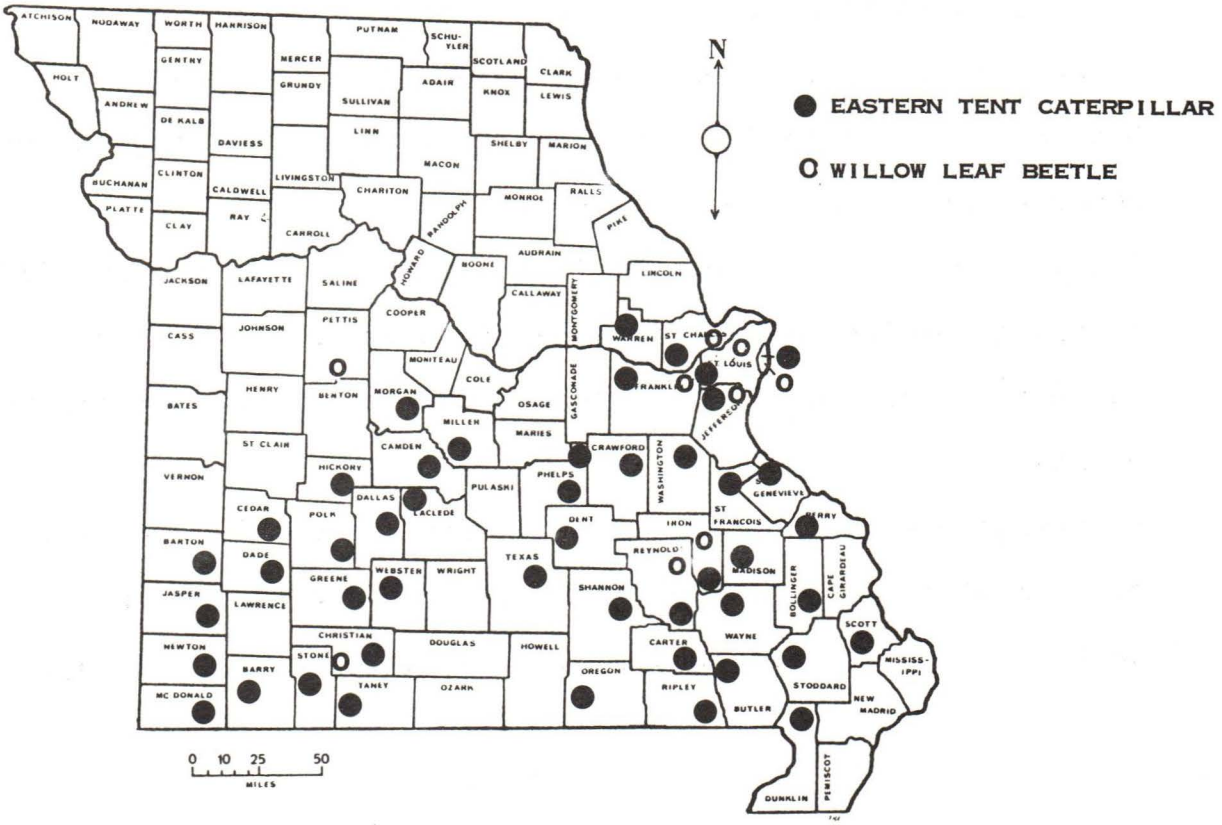
Trend - spider mite damage will be light to moderate in 1988. Although feeding seldom directly kills trees, it does stress them and damages the aesthetic value of Christmas trees or ornamental plants.

Suppression - arborists use a miticide to control the various species of spider mites. Christmas tree producers spray their Scotch pine trees for spider mites as the problem develops.

White Pine Aphid - population were light to moderate in the St. Louis area and in St. Joseph. The aphid sucks the sap from small twigs and needles. The honeydew which the aphid produces eventually turns a gray-black. The aphid was reported from seven counties in 1987.

Trend - populations should be low to moderate on white pine in 1988.

Suppression - several owners had their white pine trees sprayed with an approved insecticide to control the aphid.

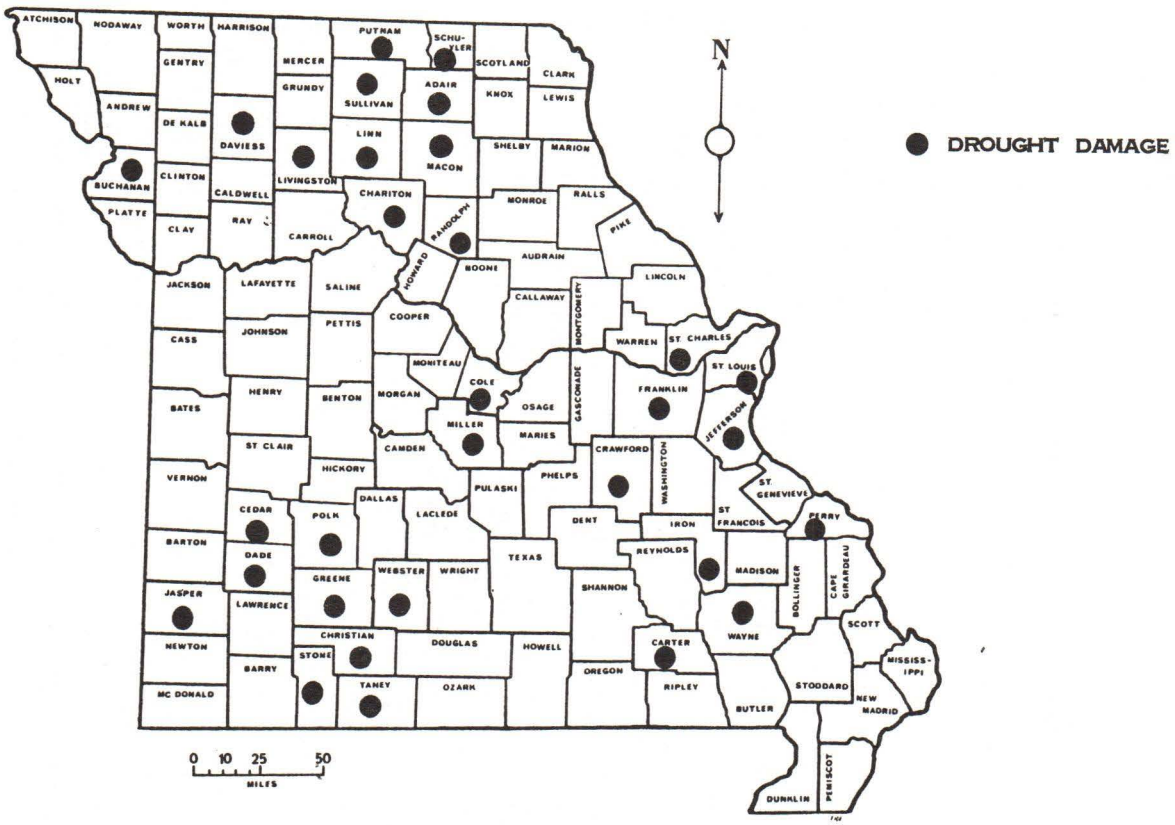


FOREST AND ORNAMENTAL TREES DISEASES

Drought Damage - Below normal precipitation levels caused damage on a variety of hardwood and conifer species statewide. Hickory, pin and other oak species, walnut, and maple exhibited varying degrees of foliar browning and premature leaf drop because of high temperatures and low soil moisture levels.

Trends - Pine wilt disease on Scotch pine, oak decline and other decline diseases that increase after periods of drought, may become more prevalent in 1988.

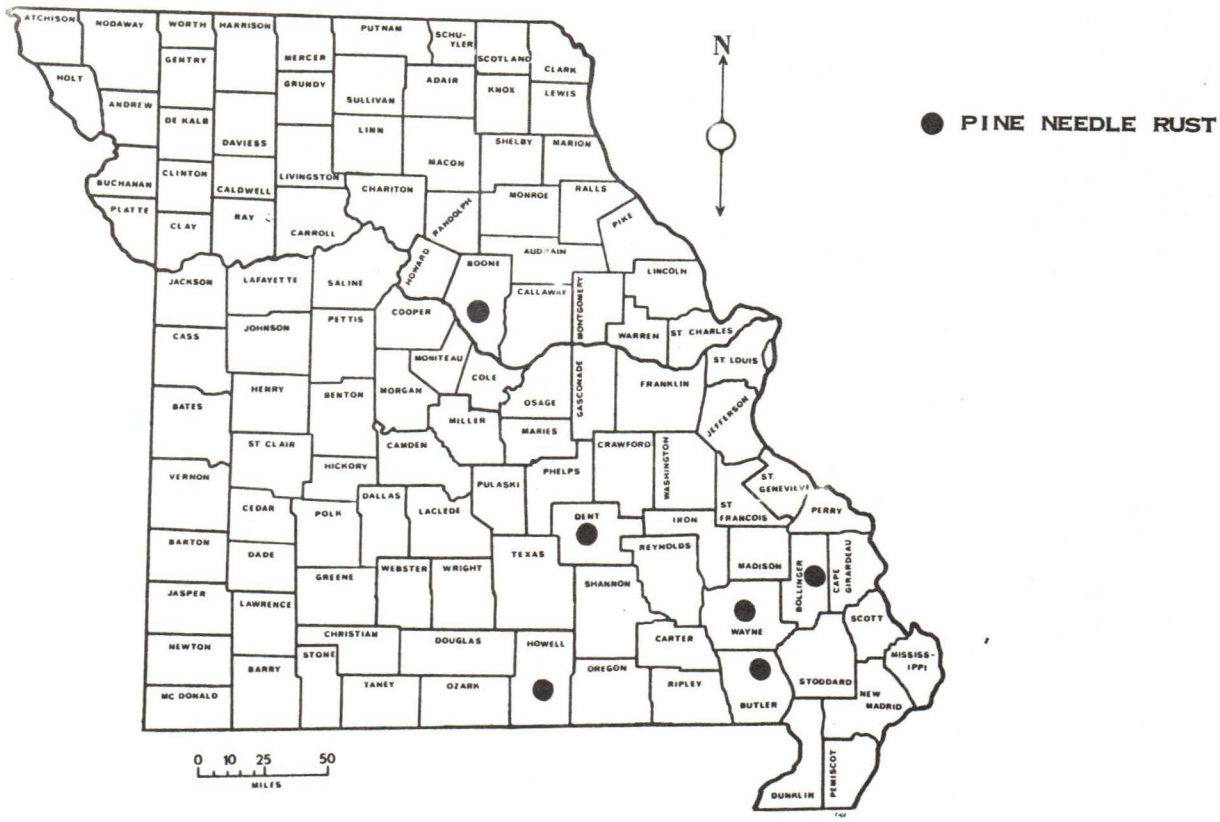
Suppression - Watering was recommended where feasible in ornamental situations.



Pine Needle Rust - Was prevalent in the range of shortleaf and loblolly pines in Missouri. The disease caused minor damage although individual trees were heavily infected.

Trend - Wet fall weather in 1986 was conducive to infection by the rust fungus. Infection levels in 1988 should decrease unless above normal precipitation occurs again this fall.

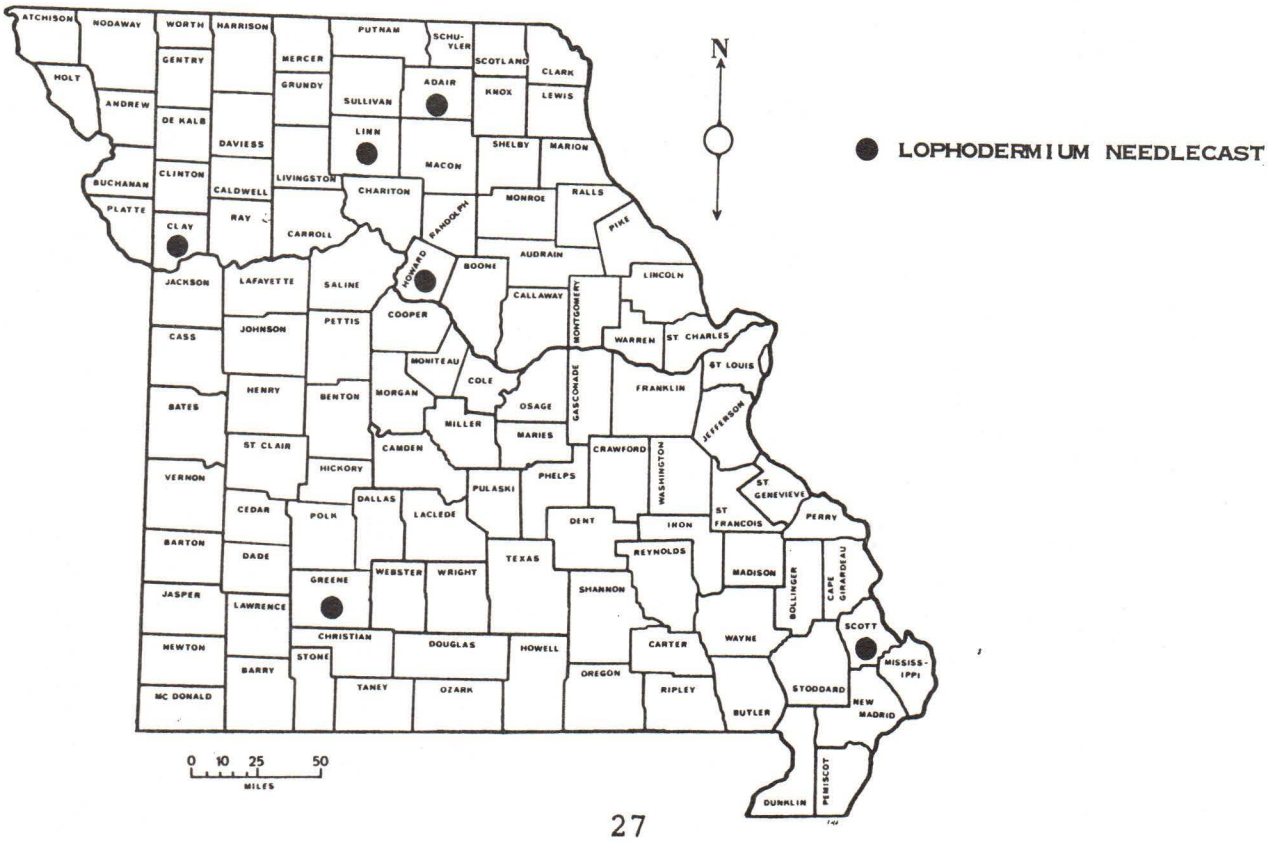
Suppression - Eradication of the alternate host of the rust fungus was recommended where the disease was severe.



Lophodermium Needlecast - The needlecast disease was found in Christmas tree plantations scattered around the state, suggesting a statewide distribution. Short-needled varieties of Scotch pine were the most severely damaged with individual trees often losing over 50% of last year's needles. Above normal precipitation levels in the fall of 1986 may be responsible for the sudden increase in the disease.

Trend - Lophodermium needlecast is usually not a problem in Missouri Christmas tree plantations. However, amplified inoculum levels are present in plantations where the needlecast was severe this year. Damage from the needlecast may continue in 1988 if environmental conditions are conducive again this fall.

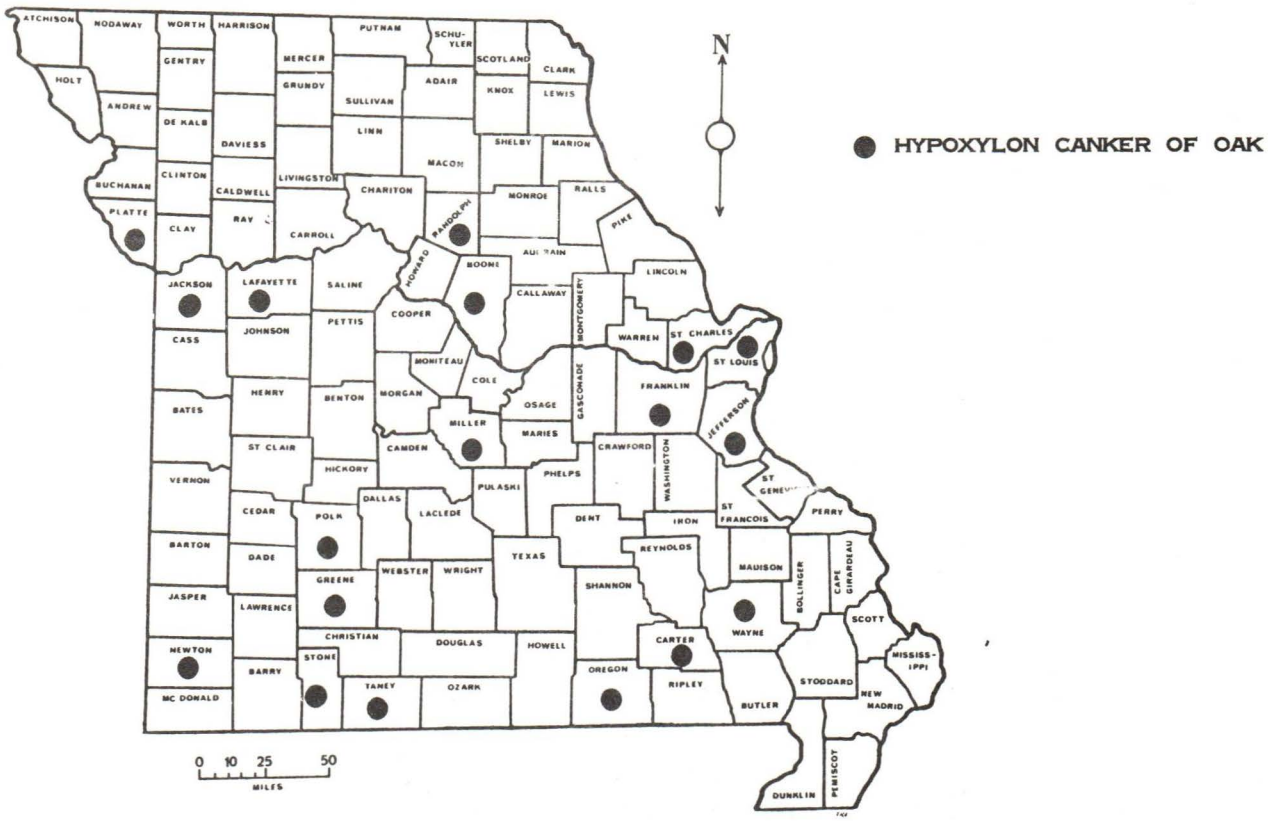
Suppression - Fungicidal sprays of chlorothalonil or maneb were initiated in late July for control of the disease. This is the first year Christmas tree growers have implemented active control measures.



Hypoxylon Canker of Oak - Affected a wide range of oak species including black, chinkapin, northern red, pin, post, scarlet, shingle, white and willow oak. Effuse stromata of the Hypoxylon fungus were found on branches and stems of both forest and shade tree oaks.

Trend - Drought conditions during this growing season continued to predispose oaks to the disease. The disease will continue to cause significant levels of branch dieback and some tree death in 1988, particularly on stressed oaks.

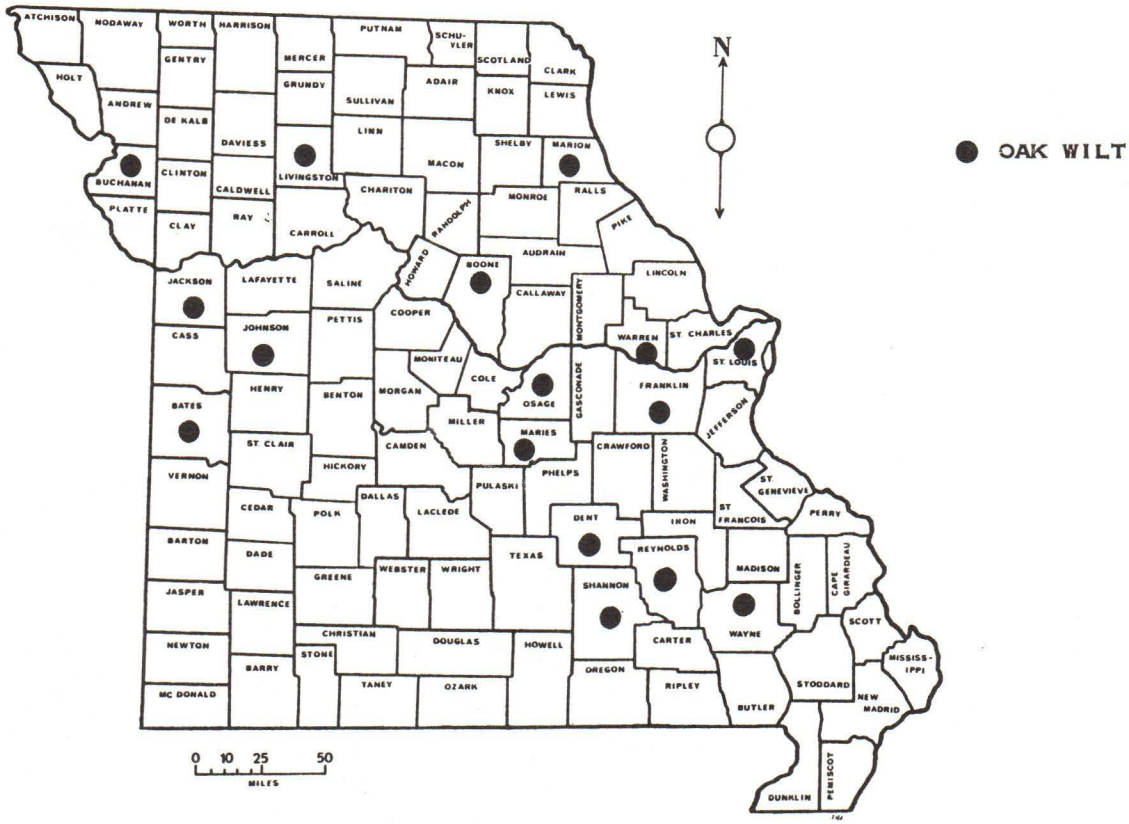
Suppression - Branches and entire trees infected with the canker were removed to reduce inoculum levels and slow spread of the disease.



Oak Wilt - was at lower levels statewide in 1987 in comparison to previous years. Northern red, black and pin oaks were the most commonly affected species. The disease was often confused with drought stress symptoms, and wilting and branch dieback caused by the two-lined chestnut borer.

Trend - Losses due to oak wilt occur annually in both forest and ornamental situations. The disease is expected to remain at endemic levels in 1988.

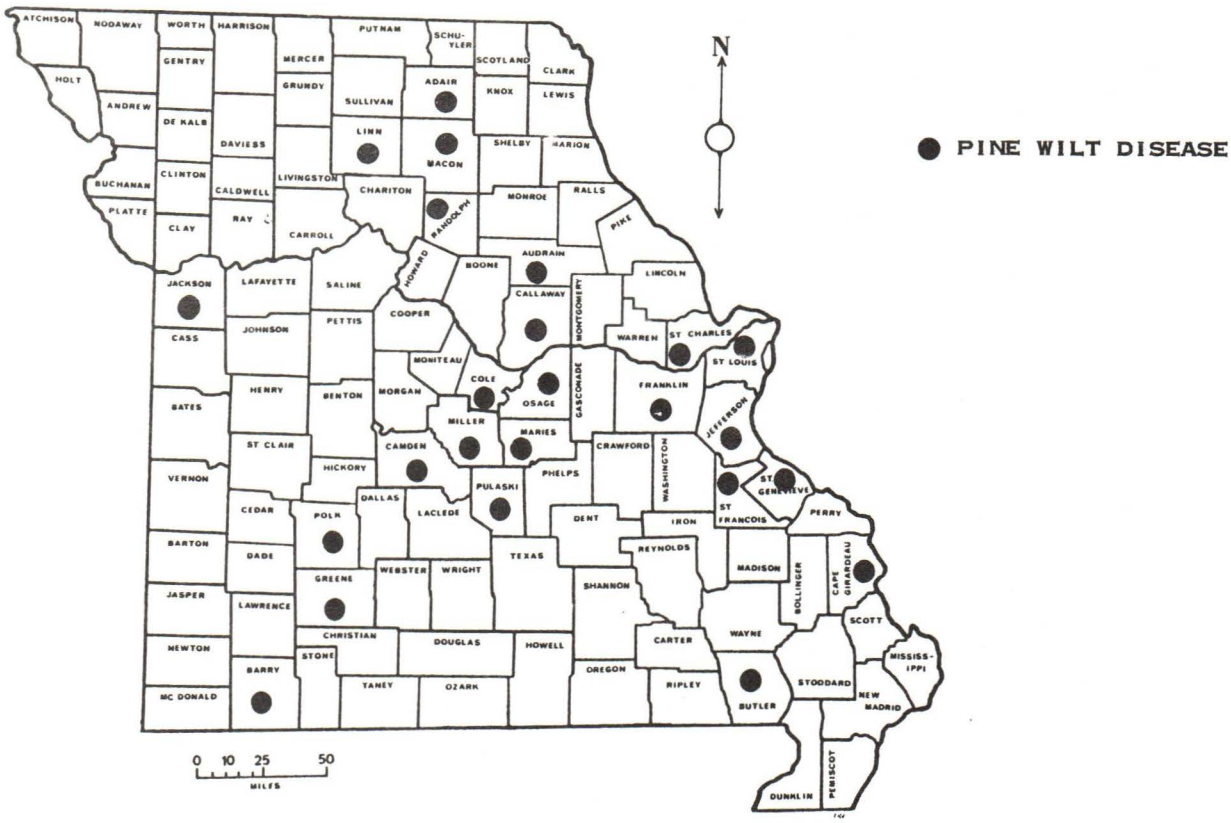
Suppression - Removal and destruction of infected trees and severing of root grafts between trees was used for the management of oak wilt. Recommendations were made to avoid pruning or wounding oaks during the spring and early summer in order to reduce the risk of long distance transmission of the fungus.



Pine Wilt Disease - Increased in 1987 and is considered epidemic on Scotch pine in Missouri. The disease killed a very large number of Scotch pine in ornamental and windbreak plantings. Austrian pine was affected to a lesser degree. Drought conditions in 1987 and recent years are apparently associated with the increased incidence of pine wilt.

Trend - Current conditions include high inoculum levels (large number of recently infected pine wilt killed trees) and a predisposed or drought stressed population of Scotch pine. High losses are expected to continue in 1988.

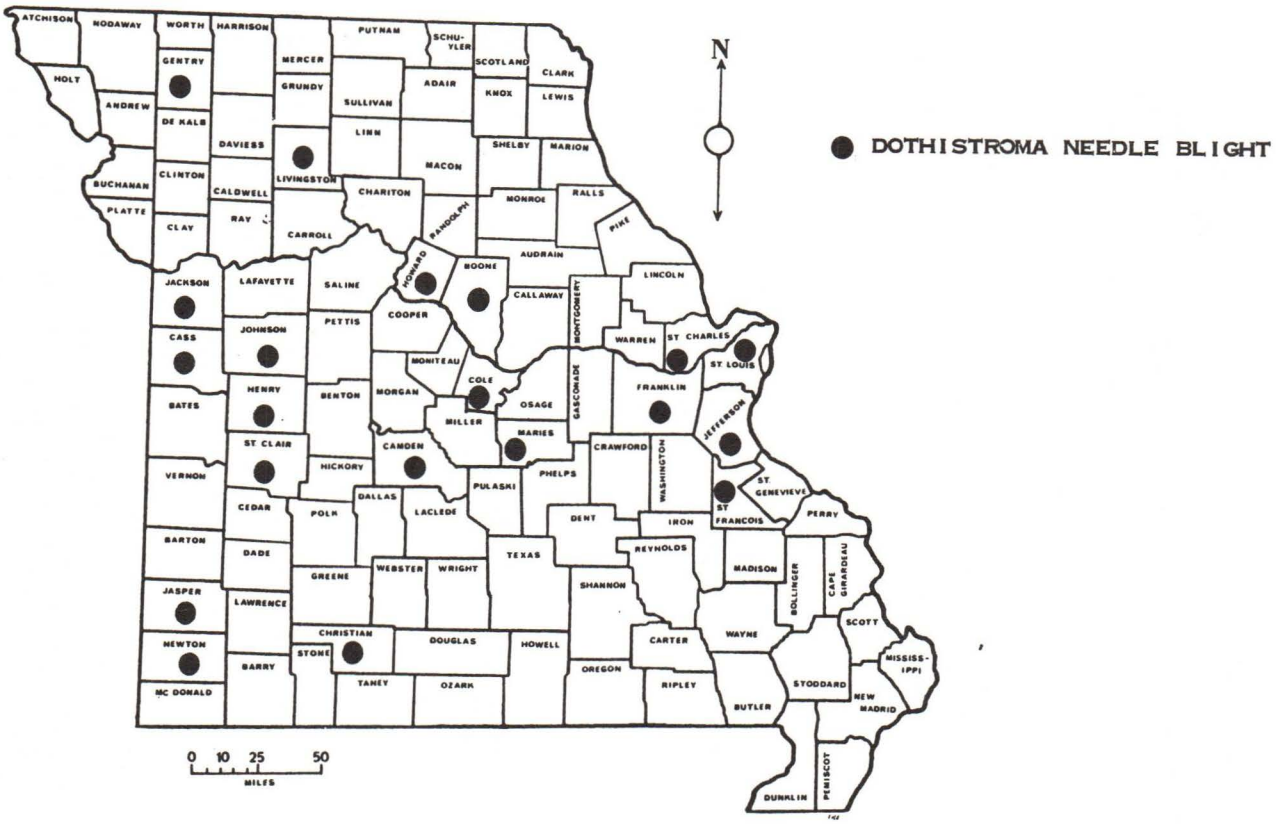
Suppression - Removal and destruction of infected pines before the end of March is the only current management practice for pine wilt. Sanitation is aimed at reducing levels of Monochamus spp. which vector the nematode.



Dothistroma Needle Blight - Was common and often severe on Austrian pine in ornamental, windbreak and Christmas tree plantings. Ponderosa pine was affected to a lesser degree.

Trend - Dothistroma was reported as a problem mainly in central Missouri in 1983. The disease was widely distributed in 1987 and will continue to damage Austrian pine wherever it is planted.

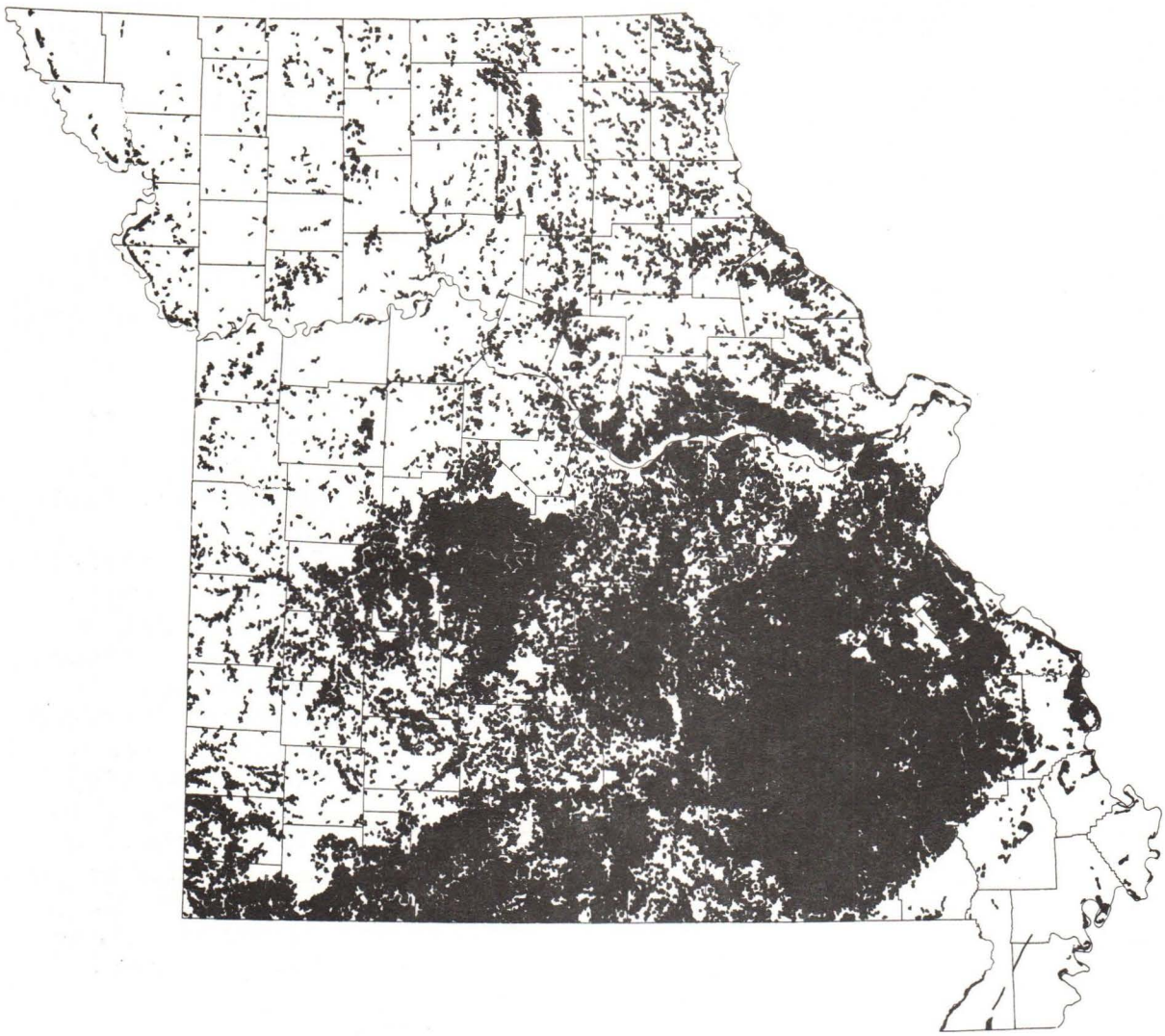
Suppression - Copper fungicides or chlorothalonil applied in mid-May and again in late June were used for Dothistroma control.



CONCLUSION

Rainfall amounts were sparse and scattered during the growing season of 1987. Central Missouri was very dry for May, June, July, August and September. Most areas of the state have partially replenished subsoil moisture levels from fall precipitation. However, we may experience increased levels of decline and stress related diseases, such as oak decline, hypoxylon canker and two-lined chestnut borer of oak, and pine wilt of Scotch pine, because of drought conditions in 1987. Most foliar diseases and insect defoliators were at relatively low levels in 1987. Damage from these pests may increase next year if environmental conditions are conducive for their development.

Because of our District pest reports we have been able to collect and assemble this statewide pest incidence information. Cooperation and team effort has always been our key to a successful Forest Pest Management Program.



FOREST COVER OF MISSOURI

Prepared By
Geographic Resources Center
University of Mo.
Columbia, Missouri
In Cooperation With
Missouri Conservation Department
Jefferson City, Mo.

FEBRUARY, 1986
Data Source: Landsat TM Imagery, 1984

INSECT-HOST	COUNTY
Bagworm Thyridopteryx ephemeraeformis(Haw.) on assorted evergreens	Statewide
Black-headed Ash Sawfly Tethida cordigera Beauvois	
Black Turpentine Beetle Dendroctonus terebrans (Oliv.)	Carter, Oregon, Reynolds, Shannon, Wayne
Borers Hardwood trees	Adair, Boone, Buchanan, Callaway, Cape Girardeau, Carter, Clay, Cole, Daviess, Franklin, Greene, Henry, Howell, Iron, Jackson, Jasper, Jefferson, Johnson, Lawrence, Newton, Perry, Ray, Reynolds, Scott, Shannon, St. Charles, St. Clair, St. Louis, St. Louis City, Stoddard, Stone, Taney, Wayne,
Carpenterworm, Prionoxystus robiniae (Peck)	
Bronze Birch Borer, Agrilus anxius (Gory)	Statewide
Cottonwood Borer, Plectrodera scalator, (F.)	
Cottonwood Leaf beetle, Chrysomela scripta, (F.)	
Cottonwood Twig Borer, Gypsonomia haimbachiana, (Kft.)	
Two-lined Chestnut Borer Agrilus bilineatus, (Web.)	In counties with stressed oak trees, statewide
Twig Girdler, Oncideres cingulata, (Say.)	Cole, Iron, Reynolds
Eastern Tent Caterpillar, Prunus sp. Malacosoma americanum, (F.)	Statewide
Elm Leaf Beetle, on elm Pyrrhatta luteola, (Mueller)	Statewide

European Pine Sawfly, Scotch and mugo pines *Neodiprion sertifer*, (Geoff)	Adair, Boone, Cass, Chariton, Franklin, Greene, Jackson, Jefferson, Johnson, Knox, Linn, Macon, Marion, Ralls, Sullivan, St. Charles, Ste. Genevieve, St. Louis, St. Louis City
Fall Webworm, on black walnut and other hardwood species *Hyphantria cunea* (Drury)	Statewide where host species occur
Gall Insects on assorted hardwoods	Statewide
Gall Wasp (on Oak), *Callirhytis punctata* (O.S.)	
Green June Beetle, on oak leaves *Cotinus nitida*, (L.)	
Gypsy Moth (on hardwoods) *Porthetria dispar* (L.)	male adults in traps in Jefferson, Pike, St. Louis
Holly Leaf Miner on American Holly *Phytomyza ilicicola*, (Loew)	
June Beetle, on oak leaves, *Phyllophaya* sp.	
Kermes Scale on white and post oak *Kermes pubescens*, (Bogue)	
Linden Wart Gall on basswood, *Cecidomyia verrucicola*, (Loew)	
Loblolly Pine Sawfly, shortleaf pine, *Neodiprion taedae linearis*, (Ross)	Bollinger, Butler, Iron, Ripley, Shannon, St. Francois

Looper Complex on hardwoods	Statewide
Nantucket Pine Tip Moth, *Ryacionia frustrana* (Comst.) on shortleaf, Scotch, mugo pines	Butler, Carter, Cass, Dallas, Greene, Jackson, Jasper, Laclede, Perry, Reynolds, Ripley, Scott, Stoddard, Ste. Genevieve, Texas
Oak Slug Sawfly, *Caliroa lineata*, (MacGillivary)	
Obscure Scale, *Melanaspis obscura* (Comst.) on pin oak	Buchanan, Cole, Lawrence, Scott, St. Louis, Stoddard
Pales Weevil, *Hylobius pales* (Hbst.) on Scotch pine	Howard, Lawrence
Pine Needle Miner, *Exoteleia pinifoliella*	(On Virginia pine) Cole
Pine Needle Scale, *Phenacaspis pinifoliae* (Fitch)	St. Louis City
Pine Tortise Scale, *Toumeyella numismatica*, (P. & McD.)	(On Scotch and shortleaf pines)
Pine Webworm, *Tetralopha robustella*, (Zeller) on Scotch and shortleaf pines	Callaway, Reynolds, Ripley, Wayne
Plant Bugs - on honey locust	Cole
Poplar Tent Maker, *Ichthyura inclusa*, (Haldeman)	
Redheaded Pine Sawfly, *Neodiprion lecontei*, (Fitch) on shortleaf and Scotch pines	Laclede, Ste. Genevieve, Wright

Scales - (hardwoods)	Buchanan, Cass, Clay, Cole, Franklin, Jackson, Jasper, Jefferson, St. Louis, St. Louis City
Scales pine	Cole, Franklin, Greene, Jackson, Jefferson, St. Charles, Ste. Genevieve, St. Louis, St. Louis City, Warren
Spider Mites, Oligonychus spp. and Tetranychus spp.	Buchanan, Butler, Cole, Dent, Franklin, Greene, Jackson, Jefferson, Laclede, Marion, New Madrid, Scott, Stoddard, St. Charles, St. Louis, St. Louis City, Taney, Wayne
True Tree Grasshopper, Dendrotettix quercus (Packard) on hardwoods	Dent, Iron, Reynolds, Texas, Wayne
Walking Stick, Diapheromera femorata, (say) (on oak leaves)	Iron
Walnut Caterpillar, Datana integerrima, (G.& P.) on walnut, pecan and hickory	Butler, Douglas, New Madrid, Perry, Stoddard
White Pine Aphid, Cinara strobi,(Fitch) on white pine	Buchanan, Franklin, Jefferson, St. Charles, St. Louis, St. Louis City, Warren
White Pine Bark Adelgid Pineus strobi (Htg.)	Buchanan, Cole, Wayne

Willow Leaf Beetle, *Chrysomela interrupta*, (F.)	Pettis
Yellow-necked Caterpillar, *Datana ministra*, (Drury) on huckleberry	
Zimmermann Pine Moth, *Dioryctria zimmermanni*, (Grote) on Scotch pine	Jasper

PEST AND HOST	COUNTY
Actinopelte Leaf Spot, Actinopelte dryina (Sacc.) Hoehn. (black cherry bark, northern red, pin, and post oaks)	Buchanan, Franklin, Greene, Jefferson, St. Charles, St. Louis, Laclede, Taney, Johnson
Air Pollution, Point source-SO_2 (black oak, hickory, winged sumac)	Iron
Air Pollution, Ozone (White pine)	St. Louis, Cole
Annosus Root Rot, Heterobasidion annosum (Fr.) Bref. (Shortleaf pines)	Wayne, Carter, Maries
Apple Scab, Venturia inaequalis (Cke.) Wint. (Crab apple)	Cole, Jackson, St. Louis
Armillaria Root Rot, Armillariella mellea (Vahl. ex Fr.) Karst. (northern red, chinkapin, white, scarlet, and post oak)	Adair, Carter, Madison, Stone, Chariton, Cape Girardeau, Knox, Linn, Macon, Putnam, Schuyler, Sullivan, Scotland, Oregon, Pulaski
Ash Anthracnose Gloeosporium aridum Ell. & Holw. (white and green ash)	Cole, St. Louis, Jefferson, St. Charles, Franklin
Ash Decline complex of biotic and abiotic factors (green and white ash)	Buchanan, Platte, St. Clair, St. Louis, Livingston
Ash Leaf Rust Puccinia sparganioides Ell. & Barth. (Ash)	Buchanan
Brown Spot Needle Blight Scirrhia acicola (Dearn) Siggers (Scotch pine)	Clinton, Christian, Gentry, Linn, McDonald, Osage, St. Clair
Cedar Apple Rust Gymnosporangium juniperi-virginianae Schw. (Apple, eastern redcedar)	Statewide
Cercospora Blight Cercospora sequoiae var. juniperi Ell. & Ev.	Boone, Cole, Texas, Moniteau

Cyclaneusma Needlecast *Cyclaneusma minus* (Butin) Dicosmo, Peredot & Minter (Scotch pine)	Christian, Jackson, Howard, Marion, St. Louis, Boone, Cole, Callaway, Polk, St. Charles, Jefferson
Cytospora Canker *Cytospora kunzei* Sacc. (Blue Norway Spruce)	Cole, St. Louis
Diplodia Tip Blight *Sphaeropsis sapinea* (Fr.) Syke & Sutton (Austrian, Scotch, mugo, ponderosa and red pines)	Andrew, Buchanan, Clay, Christian, Franklin, Greene, Henry, Jackson, Jefferson, Marion, Madison, New Madrid, Nodaway, Perry, Ripley, St. Charles, St. Louis, St. Francois, Platte
Dothistroma Needle Blight *Dothistroma pini* Hul. (Austrian, Ponderosa pines)	Boone, Camden, Cole, Cass, Christian, Frankliln, Gentry, Henry, Jackson, Jefferson, Jasper, St. Charles, St. Louis, St. Francois, St. Clair, Johnson, Howard, Maries, Newton, Livingston
Drought Damage Various hardwood and conifer species	Adair, Christian, Crawford, chariton, Cole, Daviess, Franklin, Greene, Jefferson, Iron, Jasper, Livingston, Linn, Knox, Macon, Putnum, Randolph, St. Charles, St. Louis, Stone, Schyler, Sullivan, Scotland, Shelby, Webster, Taney, Wayne, Carter, Cedar, Daue, Polk, Buchanan, Perry
Dutch Elm Disease *Ceratocystis ulmi* (Buism.) Moreau (American elm)	Audrain, Buchanan, Boone, Butler, Carter, Cole, Cooper, Clay, Callaway, Dent, Franklin, DeKalb, Greene, Howard, Howell, Henry, Jackson, Jefferson, Jasper, Lafayette, Madison,

Dutch Elm Disease (cont.)	Moniteau, Newton, New Madrid, Osage, Phelps, Perry, Ray, St. Charles, St. Louis, Stoddard, Wayne
Eastern Gall Rust *Cronartium quercum* (Berk.) Miyabe ex. Shirai f. sp. *echinatae* (Shortleaf pines)	Dent
Elm Phloem Necrosis Mycoplasma (American elm)	Jackson, Johnson, Wayne, Boone, St. Louis, Jefferson, St. Charles
Fireblight *Erwinia amylovora* (Burr.) Winsl. (pear, apple)	Carter, Franklin, Greene, Jefferson, St. Charles, St. Louis, St. Francois, Wayne
Frost Damage (Poplar, Dogwood, Maple, Willow, Magnolia, and various hardwoods)	Polk, Greene, Butler, Wayne, Carter, Jackson, Iron, reynolds, Barton, Berry, Jasper, Lawrence, Newton, McDonald, Cole
Fusarium Canker *Fusarium solani* (Mart.) Appel & Wollenw. emend synd. & Hans. (Black walnut)	Texas
Hypoxylon Canker *Hypoxylon atropunctatum* (Schw. ex. Fr.) Cke. (black, chinkapin, northern red, pin, post, scarlet shingle, white and willow oaks	Platte, Jackson, Newton, Lafayette, Polk, Greene, Stone, Taney, Randolph, Boone, Miller, Oregon, Carter, Wayne, St. Charles, Franklin, St. Louis, Jefferson
Iron Chlorosis mineral deficiency (Pin oak)	Marion, St. Louis, St. Charles, Jefferson, Buchanan, Cole
Kabatina Blight *Kabatina juniperi* Schn. & V. Arx. (Eastern redcedar)	Iron, St. Louis

Lophodermium Needlecast *Lophodermium seditiosum* Minter, Staley & Millar (Scotch pine)	Adair, Clay, Greene, Howard, Linn, Scott
Low Temperature Injury Dawn redwood	Callaway, Jasper, Jackson
Maple Anthracnose *Gloeosporium apocryptum* Ell. & Ev. (Sugar maple)	Taney, Stone, Greene, Adair
Maple Decline Complex of biotic and abiotic factors (Norway, sugar, silver, and red maples)	St. Louis, Jefferson, St. Charles, Franklin, Bollinger, Greene, Osage, Wayne
Mycosphaerella Leaf Spot *Mycosphaerella juglandis* Kessler (black walnut)	Cole, Howard
Oak Anthracnose *Gnomonia quercina* Kleb. (White, bur, post and red oaks	Taney, Stone, Greene, Butler, Cape Girardeau, Howell
Oak Decline Complex of biotic and abiotic factors (scarlet, black, pin, northern red, white, post and other oak species)	Boone, Cole, Warren, Reynolds, Laclede, St. Francois, Randolph, Wayne, Carter, Dent, Phelps, Greene, Polk, Jackson, St. Louis, Jefferson, St. Charles
Oak Wilt *Ceratocystis fagacearum* (Bretz) Hunt (Black, pin, red and other oak species)	Buchanan, Jackson, Bates, Johnson, Livingston, Boone, Osage, Maries, Dent, Shannon, Reynolds, Wayne, Franklin, Warren, St. Louis, Marion
Peach Leaf Curl *Taphrina deformans* (Berr.) Tul. (peach)	Marion, Dallas
Pecan Scab *Cladosporium caryigenum* (Ell. et. Lang) Gott (pecan)	Vernon

Phomopsis Blight *Phomopsis juniperovora* Hahn. Eastern redcedar and other *Juniperus* spp.)	Boone, Cape Girardeau, Dent, Franklin, Jefferson, St. Charles, St. Louis, Taney, Texas
Pine Needle Rust *Coleosporium asterum* (Diet.) Syd. (shortleaf and loblolly pines)	Bollinger, Boone, Butler, Howell, Dent, Wayne
Pine Wilt Disease *Bursaphalenchus xylophilus* Steiner & Burher (Scotch and Austrian pines)	Jackson, Barry, Polk, Greene, Linn, Camden, Adair, Macon, Randolph, Cole, Miller, Audrain, Callaway, Osage, Maries, Pulaski, Franklin, St. Charles, St. Louis, Jefferson, St. Francois, Ste. Genevieve, Cape Girardeau, Butler
Rhizosphaera Needlecast *Rhizosphaera kalkhoffi* Bub (blue spruce)	Adair, Boone, Buchanan, Cole, Camden, Callaway, Dent, Franklin, Howell, Greene, Jasper, Jackson, Jefferson, Jackson, Knox, Livingston, Linn, Maries, Macon, Newton, Phelps, Polk, Putnam, Reynolds, Scotland, Schulyer, Stone, Sullivan, St. Charles, St. Louis, Taney, Wayne
Sapsucker Damage *Sphyrapicus varius* (yellow-bellied sapsucker) (Norway Spruce, walnut, pecan, Scotch pine, cedar, maple, Austrian pine, Shortleaf pine, river birch)	Crawford, Taney, Greene, Warren, Cole, Dunklin, Boone, Jackson, Polk, New Madrid, Ozark, Iron, Reynolds, St. Louis, St. Charles, Jefferson, Franklin, Camden, Howard, Laclede
Slime Flux *Erwinia spp.* (white, pin & shingle oaks; elm)	Butler, Cole, Johnson, St. Louis
Sycamore Anthracnose *Gnomonia plantani* Edg. (American sycamore)	Adair, Boone, Carter, Cole, Greene, Franklin, Jefferson, New Madrid, Pemiscot, St. Charles, St. Louis, Taney, Wayne

Tar Spot *Rhytisma acerinum* Pers. ex. Fr. (silver maple)	Goddard
Verticillium Wilt *Verticillium dahliae* Leb. (sugar maple, red maple, and redbud)	Boone, Buchanan, Cooper, Cole, Dallas, Greene, Jasper, Jackson, Lawrence, Marion, Newton, St. Francois
Walnut Anthracnose *Gnomonia leptostyla* (Fr.) Ces. & den (Black walnut)	Boone, Cole, Texas, Greene
Winter Burn and Drying (Scotch pine, yew, Northern White Cedar)	Andrew, Buchanan, Barton, Clay, Jackson, Jefferson, St. Charles, St. Louis, Taney

EASTERN REDCEDAR (*Juniperus virginiana*) Phomopsis blight (*Phomopsis juniperovora*)

C.J. Luley, J. Dillard and W.G. Yoder

EVALUATION OF TWO FUNGICIDES FOR CONTROL OF PHOMOPSIS BLIGHT ON EASTERN REDCEDAR SEEDLINGS, 1987: Fungicidal control of Phomopsis blight was evaluated on 1-0 eastern redcedar at the George O. White State Nursery, Licking, Missouri. Nursery beds were fumigated in August with methyl bromide and then planted with seed collected from central Missouri (10 Sept) in 4 rows with 12 in spacing between rows. For the experiment, a single bed was divided into 4 randomized complete blocks that contained 6 ft plots and 1 ft buffers between plots. Fungicide treatments were applied to runoff with a 2 gal hand held pneumatic sprayer on a 10 or 20 day schedule from 3 Apr to 29 Oct. Overhead irrigation was used regularly during the growing season due to low moisture levels and high temperatures. The percentage of infected plants in the inner two rows was determined on 18 Sep and 30 Oct. Treatment means were compared after analysis of variance using orthogonal contrasts.

Disease pressure as measured by percent of infected seedlings was moderate but increased in severity from Sep to Oct. Significant differences (P=0.05) at both rating dates were present between the benlate and manzate treatments and between the 10 and 20 day spray schedules when all treatments were

combined. Differences were not significant between the rogued and nonrogued benlate treatments, 10 and 20 day benlate treatments, and 10 and 20 day benlate-manzate combination treatments. There were also no significant differences (P=0.05) amongst treatments in the number of seedlings per row ft which averaged 13.7 at the time disease ratings were made.

	Percent Infected Seedlings**	
Treatment and Rate/100 gal*	Sep 18	Oct 30
Control	33.0	53.6
10 Day Benlate 50WP 1.0 lb	2.5	3.7
10 Day-Rogue Benlate 50WP 1.0 lb***	1.3	2.6
10 Day Manzate 200 80WP 2.0 lb . .	6.7	16.8
10 Day Benlate 50WP 0.5 lb + Manzate 200 80WP 1.0 lb	1.0	5.4
20 Day Benlate 50WP 1.0 lb	7.5	11.9
20 Day-Rogue Benlate 50WP 1.0 lb***	8.2	11.2
20 Day Manzate 200 80WP 2.0 lb . .	26.3	45.9
20 Day Benlate 50WP 0.5 lb + Manzate 200 80WP 1.0 lb . . .	6.7	10.4

* The spreader sticker Activator-90 was used in all treatments at a rate of 10 oz / 100 gal.

** Treatment means were compared using orthognal contrasts and the comparisons are discussed in the text above.

***Infected plants were rogued from the outer two rows of these treatments.